QUARTERLY PROGRESS REPORT

October 1 to December 31, 1968

Prepared for the
National Aeronautics and Space Administration
Washington, D.C. 20546

By the
New England Research Application Center
School of Business Administration
University of Connecticut
Storrs, Connecticut 06268

NASA Contract NSR 07-002-037

December 31, 1968

NEW ENGLAND RESEARCH APPLICATION CENTER
University of Connecticut

QUARTERLY PROGRESS REPORT
October 1 to December 31, 1968

SUMMARY

Progress for the work done under NASA Contract No. NSR 07-002-037 for the period October 1 to December 31, 1968 is described. The rate of growth of sales to annual industrial clients established during the previous quarter is shown to be maintained. Sales to the non-industrial sector, exclusive of special projects, also shows a healthy tendency. Quantitative particulars of performance in accordance with the NASA reporting requirements are given together with short reviews of the progress of special projects.

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During the quarterly period under review the rate of growth, both of the numbers of annual industrial clients and of the industrial sales/income resulting therefrom, has reassuringly maintained itself as compared with the previous quarter. Figure 1 (Page 18) demonstrates this clearly. Figure 2 (Page 19) is included for the sake of completeness and shows the continuing fall in sales to intermittent or ad hoc industrial users. Since the starting date for the contract, industrial sales in round figures amount to $23,000, of which $18,000 comes from annual clients.

Also in this quarter, services to the non-industrial sector; i.e., to academic and not-for-profit institutions, has shown a reassuring trend.

Total income for strict information services alone amounted to just under $2500 for the quarter. This figure does not include special projects for the non-industrial sector. Monthly income from individual faculty members at UConn is now at a level of $400, and a goal to double that amount has been set for this time next year. The departments involved during the past 3 months were Architecture, Low Temperature Physics, Electrical Engineering, Chemistry, Aerospace Engineering, Civil Engineering, Nutrition, and Poultry Science.

Also on an increase was demand from other universities and not-for-profit institutions. Those involved were Yale, Rensselaer Graduate Center, University of Hartford, Wesleyan University, the Connecticut State Department of Mental Health, Connecticut Research Commission, the Connecticut State Technical Services Program, and the Institute for the Future.

Income from these universities and institutions is running at a rate of approximately $500 a month; a 12-month goal of $1,000 a month has been set.

Overall, during the past quarter, 36 comprehensive retrospective searches have been performed, 8 current awareness services initiated, and 356 documents have been retrieved and delivered to clients.

The following tabulation describes the nature of the sources of the search requests:

	Retrospective Searches	Current Awareness Searches
Annual Industrial Clients	15	1
Annual Non-Industrial Clients	3	2
Ad Hoc Industrial Companies	2	-
UConn Faculty Members	7	3
Members of Faculties of Other Connecticut Universities	5	1
Not-for-Profit Institutions	4	1

Continuing effort is being made to improve the information services offered and to reduce the cost of these services. In this connection, discussions have taken place with representatives of Bio Abstracts, Engineering Index, Chem Abstracts, the Institute for Scientific Information, the Information Company of America. The

New England Marine Resources Information Program, the Vision Information Center, the Association of Special Libraries in Britain, the Cryogenic Data Center, and the American Psychiatric Association were used for the first time.

Liaison with university librarians is expanding, and it is firmly expected (as mentioned above) that funds will be forthcoming from Yale, Wesleyan, and UConn librarians during the coming quarter.

Progress on the various special projects continues well:

1. Impact Research

   Three cases of industrial client/NERAC relations were completed during the quarter and can be found in Appendix B (Page 20).

2. Searches for Sister RDCs

   This work continues. An amended scale of charges is now in effect.

3. Connecticut Research Commission

   (a) Searches for Independent Research Workers

   The information services for independent researchers under an award from the Connecticut Research Commission have been rounded off, and the job of evaluating these services has begun. Comments from the individuals served are being received by Dr. Harold Abramson of the Department of Sociology and Anthropology at UConn, who is performing the evaluation for NERAC. Abramson's report will be issued before the end of March.

(b) Metal Joining and Coating Information Service

The first of a monthly abstract digest of information in both these fields (compiled by Wayne State University) was dispatched to participating Connecticut companies in December and has been well received.

4. The Provision of a Selective Dissemination of Information Service for University of Connecticut Faculty Based on the Information Resource of the Institute for Scientific Information

This project, funded by the Wilbur Cross Library of UConn and participating faculty members with NERAC playing the role of a catalytic agent, is now complete. Three subscribers have already decided to continue their service via NERAC and funded by themselves.

5. Joint Project with the Engineering Experiment Station and the Labor Education Center of the University of Connecticut

The aim of this project is the indentification of major technological changes affecting the metal-working industry during the next decade. The work continues satisfactorily.

6. COMTECH - University of Massachusetts

COMTECH has become an annual non-industrial member of NERAC for the purpose of receiving digests containing encapsulated and succinct information about new technological advances possessing more-than-average commercial utility for Massachusetts industry. digests will be issued every 2 months.

In addition to the on-going projects, further consideration has been given during the quarter to new projects with the Small Business Administration, the New England and Connecticut State Technical Services Programs, and the U.S. Department of Health, Education and Welfare.

The quarter's activities have involved the Computer Division in 131 Current Awareness searches and 108 Retrospective searches. Progress towards a changeover to the IBM 1130 continues well.

The contract reporting requirements agreed between NASA and NERAC and coming into effect 1 July 1968 are a convenient means of referring to other particular aspects of the work accomplished during this quarter. Of the fourteen separate requirements, numbers II, III, IV, V, VI, VII, XI and XIII are reported here*. Numbers I and XIV are omitted by agreement with NASA as not appropriate for a published progress report. Numbers VIII, IX and X are omitted by agreement, as being unnecessary at this time. Number XII (microfiche issued to annual clients by STAR category) is also omitted since NERAC has no microfiche facility. The following comments and amplifications relate to each of the reporting requirements as identified.

NASA RDC Reporting Requirement No. II

Income (Sales) by Source -- (See Page 9)

The total sales in round figures since the starting date for the contract (1 April 1968), excluding the NASA contract funds but including the NASA funds for

*Appendix A, Page 8

impact studies, is $50,300 ($30,000)*. Industrial sales represent $23,000 ($10,500)*. Of this, $18,000 ($4,700)* is the result of sales to annual industrial clients; the remaining $5,000 ($5,800)* coming from intermittent industrial use of NERAC.

NASA RDC Reporting Requirement Nos. III and IV

Annual Industrial Clients - S.I.C. Code (See Page 10)

Industrial Ad Hoc Clients - S.I.C. Code (See Page 11)

Although the reporting requirement asked for 4-digit S.I.C. codes, primary codes only are given since the spread of 4-digit codes within such a small number of companies gives an almost meaningless chart. Four digit codes are, however, being collected and a switch will be made in the reporting when appropriate. The figures are cumulative from the beginning of operations in 1967.

NASA RDC Reporting Requirement No. V

Size of Annual and Ad Hoc (Industrial) Clients (See Pages 12 and 13)

The figures are cumulative from the beginning of operations in 1967.

*Amounts in parentheses are the corresponding figures for the same period in 1967.

NASA RDC Reporting Requirement No. VI

Marketing Approaches (Industrial Client Solicitation) (See Page 14)

Liberty has been taken with the form of presentation here since the original requirement appeared to confuse what are essentially triggers for action with the action itself. Also, it is useful to associate the results of industrial solicitation during the period with the statistics and these, therefore, are also included. The results cover the period October 1 to December 31, 1968.

NASA RDC Reporting Requirement Nos. VII, XI and XIII

NERAC Marketing and Service Contacts with Annual Clients (See Page 15)

STAR Categories (See Page 16)

Hits/Abstracts/Documents (See Page 17)

No comment on any one of these reports seems called for.

APPENDIX A

NASA RDC REPORTING REQUIREMENT NO. II

Income (Sales) by Source for 4th Quarter 1968

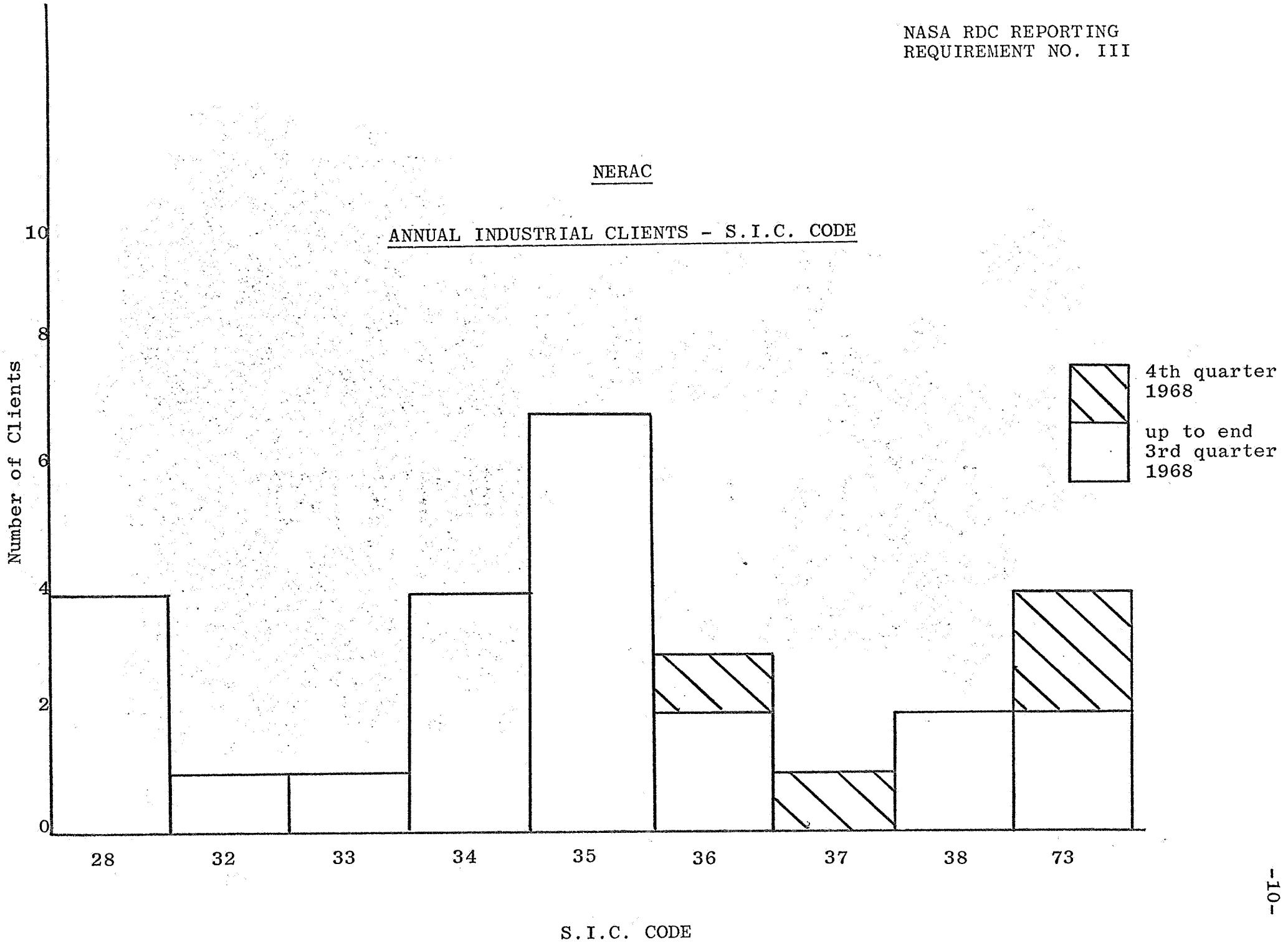
Industry			Non-Industrial	
Annual	Ad Hoc	RDCs	Annual	Ad Hoc
6,500	300	1,561*	1,000	2,370

*Includes income for September 1968 also.

NASA RDC REPORTING
REQUIREMENT NO. III

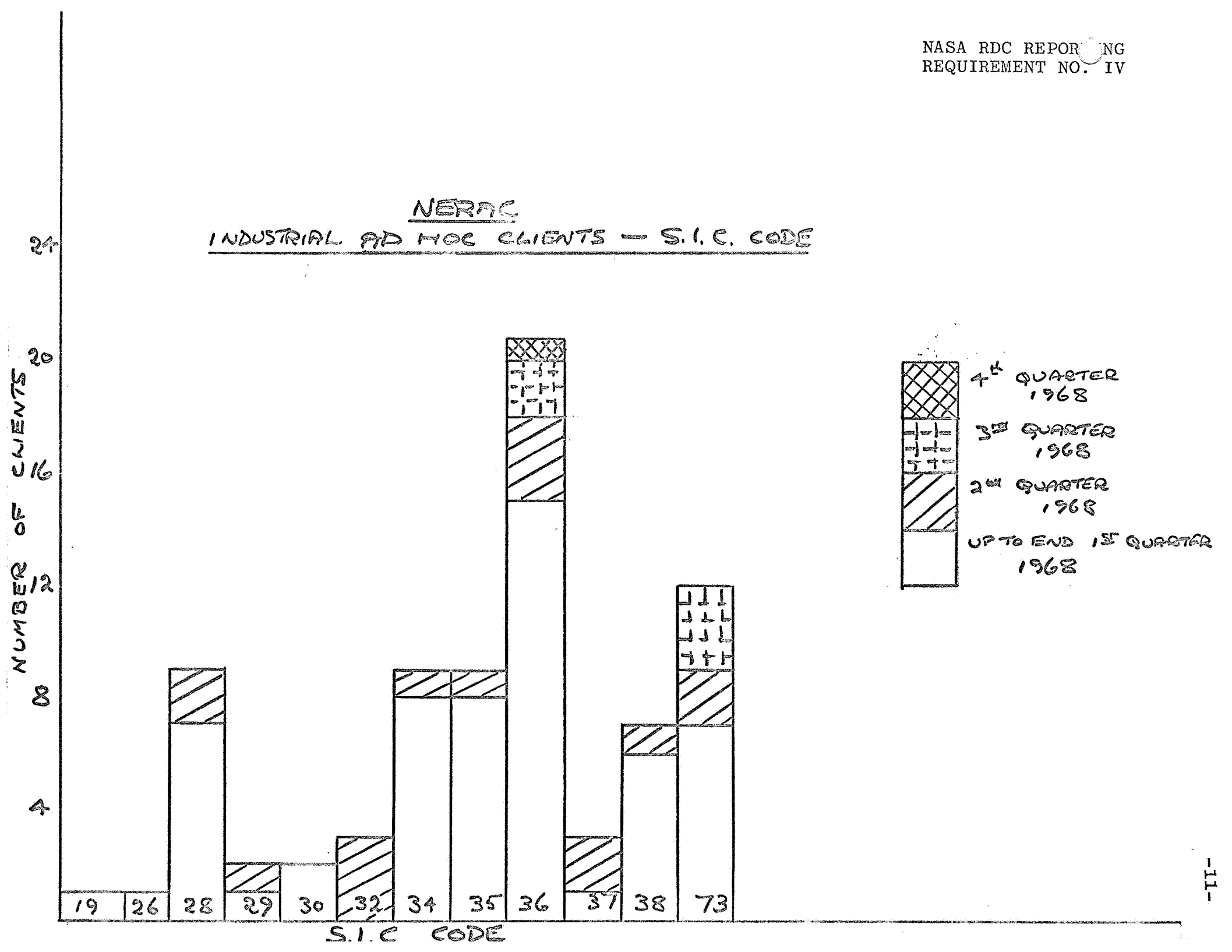
NERAC

ANNUAL INDUSTRIAL CLIENTS - S.I.C. CODE

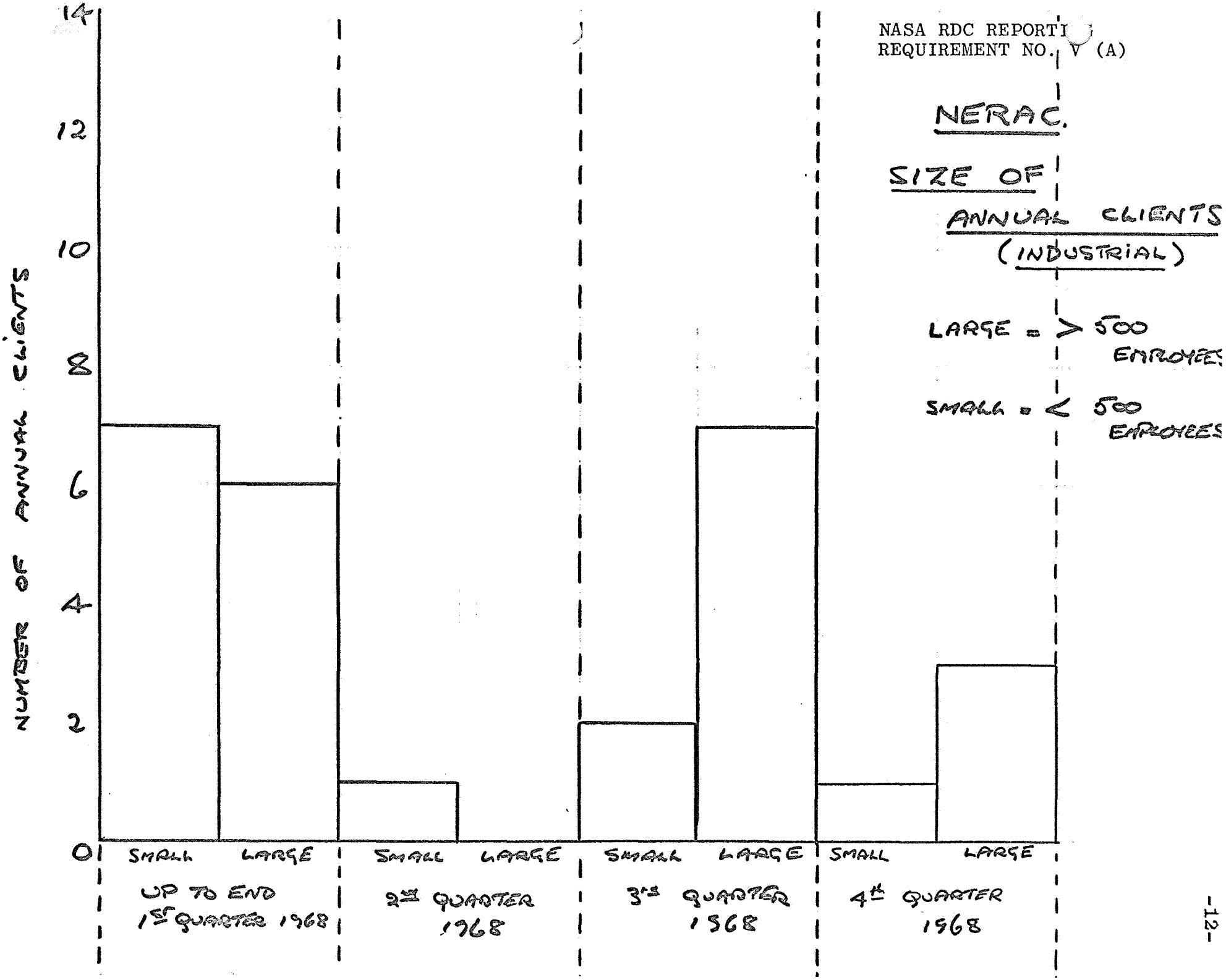


NERAC

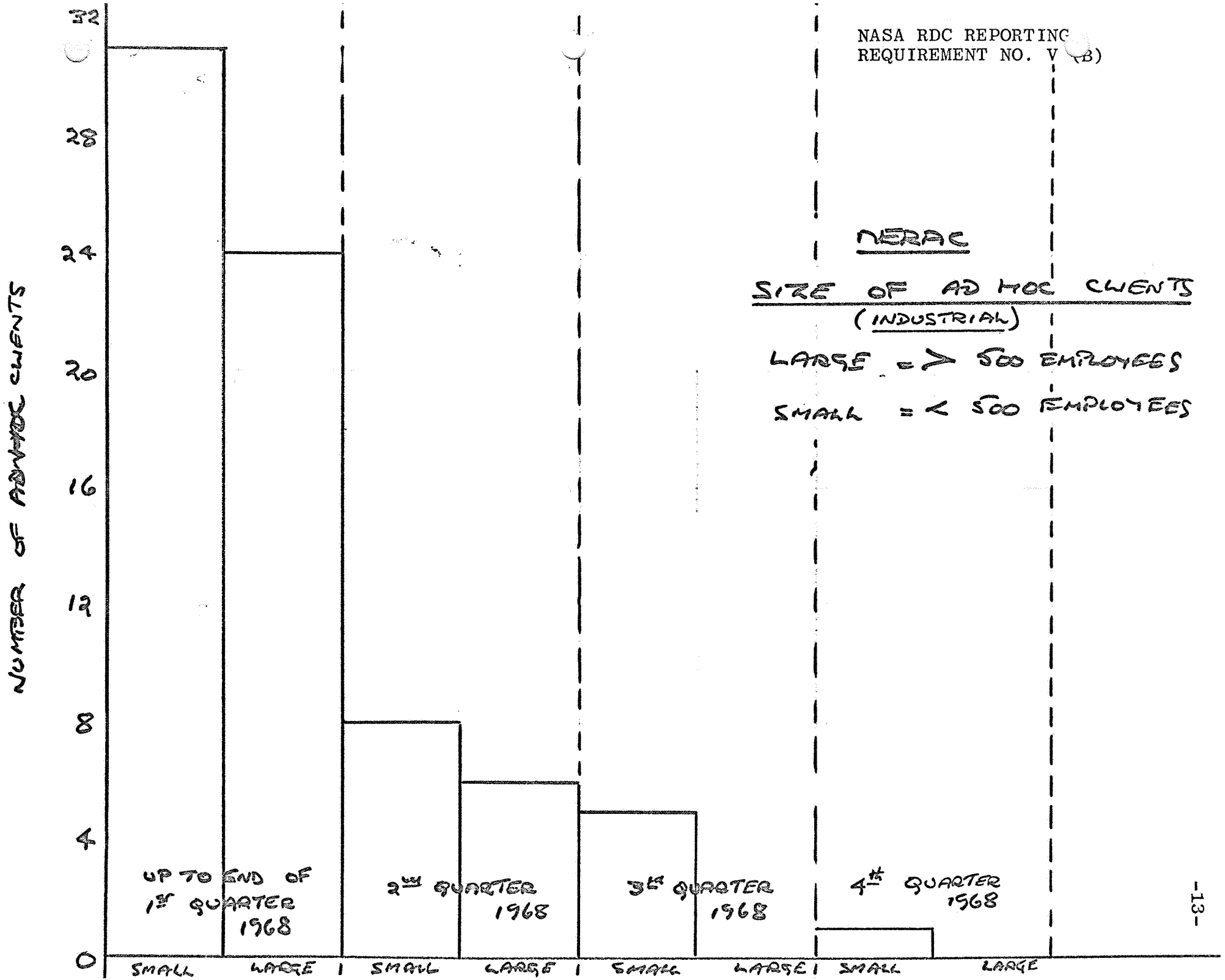
INDUSTRIAL AD HOC CLIENTS — S.I.C. CODE



NASA RDC REPORTI
REQUIREMENT NO. V (A)



NASA RDC REPORTING
REQUIREMENT NO. V (B)



NASA RDC REPORTING REQUIREMENT NO. VI — MARKETING APPROACHES

NERAC Industrial Client Solicitation

	for 4th quarter 1968
(1) Origin of Leads	
New marketing initiated by NERAC	43
Previous contacts	-
Previous ad hoc clients	-
Referred by clients	-
Referred by other prospects	1
Referred by CRC and CDC	2
Referred by NASA & NASA publication	3
Response to group presentations	-
Response to ads	3
Response because of journal articles	5
Referred by other miscellaneous sources, e.g., SBA, RDCs, UConn School of Business	8
Total	65
(2) Industrial Lead Follow-up Statistics	
Letter contacts	44
Phone contacts	86
Personal presentations and visits	51
Group presentations	-
(3) Results of Industrial Solicitation	
Annual members	4
Renewal of previous annual members	1
Current awarenesses	-
Ad hoc clients	1
Active prospects	20
Unresolved	19
Negative	21
Total	65

NASA RDC REPORTING REQUIREMENT NO. VII

NERAC Marketing and Service Contacts with Annual Clients

Staff Type	Contact Type	For 4th Quarter 1968
Marketing	Telephone	6
	Letter	16
	Visit	1
Technical and Information	Telephone	18
	Letter	112
	Visit	0

NASA RDC REPORTING REQUIREMENT NO. XI

STAR CATEGORIES

3rd quarter 1968

	1	3	4	5	6	8	9	10	11	12	14	15	16	17	18	23	25	26	33
For CAs	4	9	-	-	7	1	1	1	1	2	1	5	-	4	2	1	1	-	-
For Annuals	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
For Ad Hocs	-	1	2	4	2	-	3	1	1	-	-	9	3	-	-	-	1	12	1
Totals	4	10	3	4	11	1	4	1	2	2	1	14	3	4	2	1	2	12	1

Total number of documents for CAs - 40
Total number of documents for Annuals - 3
Total number of documents for Ad Hocs - 40

Grand Total 83

NASA RDC REPORTING REQUIREMENT NO. XIII

3rd quarter 1968

Hits/Abstracts/Documents

	Hits	Abstracts	Documents	
For Current Awarenesses	1,357	605	40	for 14 companies and 16 subjects
For Annuals	3,600	268	3	for 9 companies and 22 subjects
For Ad Hocs	3,682	299	39	for 9 companies and 15 subjects
	8,639	1,172	82	

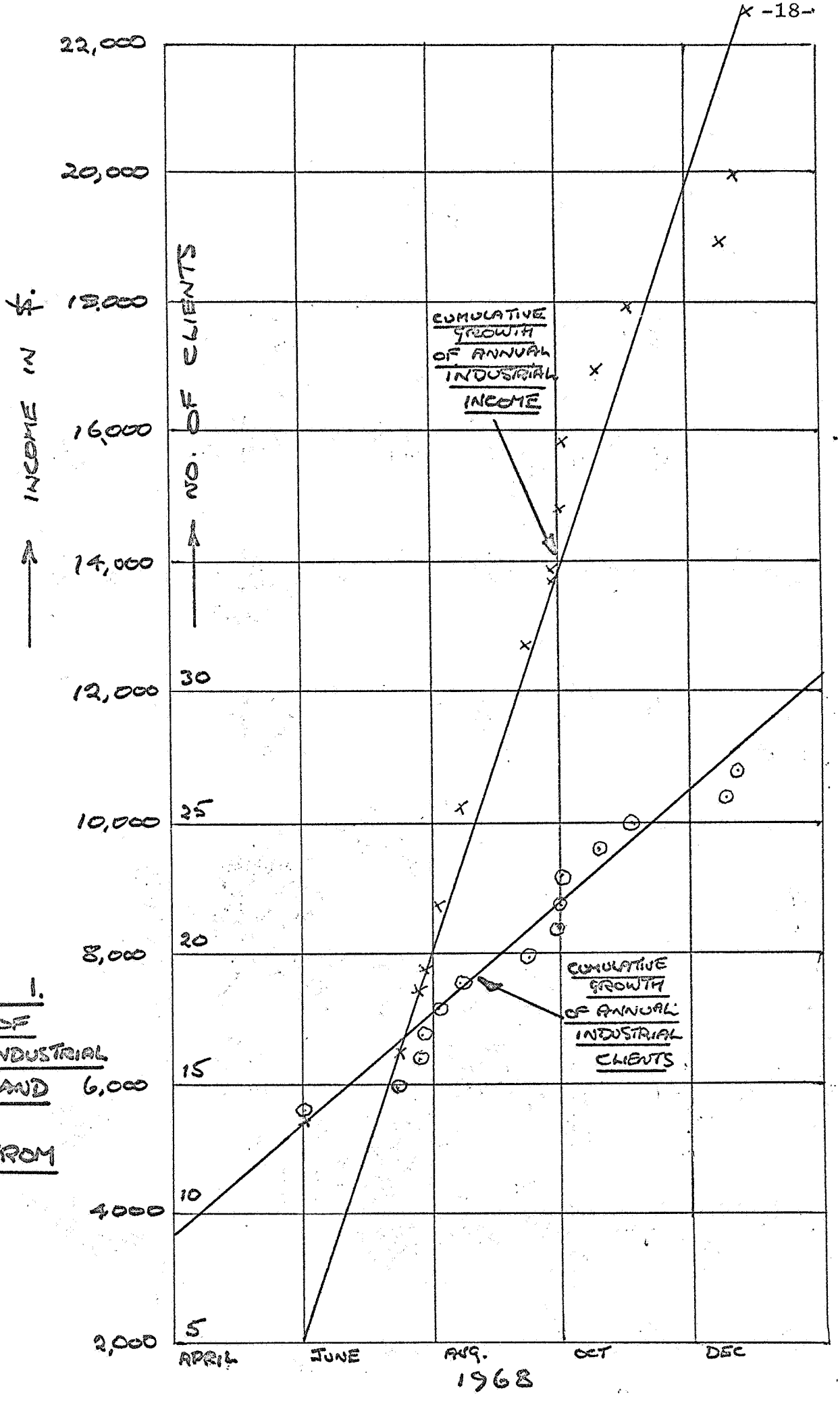
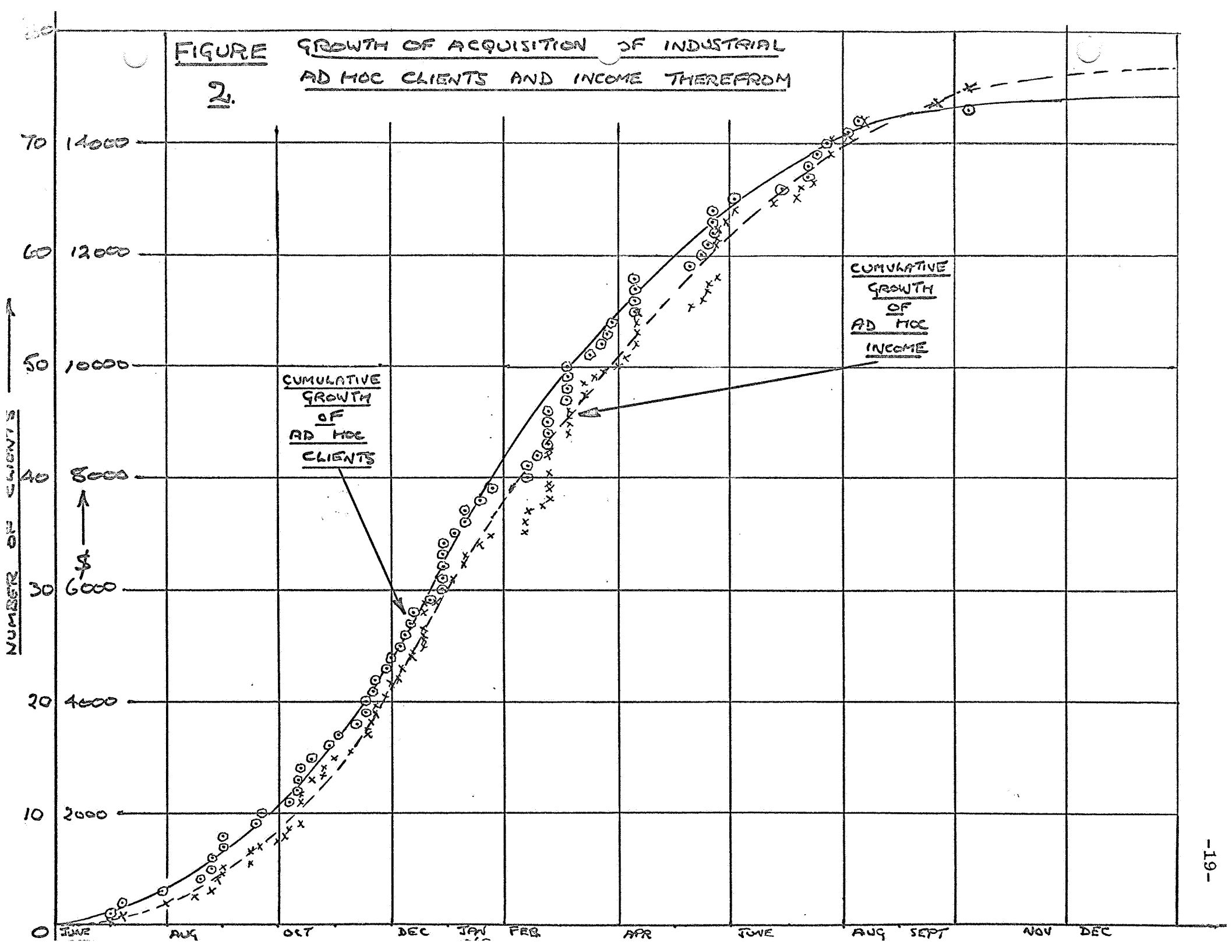


FIGURE 1.
GROWTH OF ANNUAL INDUSTRIAL CLIENTS AND INCOME THEREFROM

FIGURE 2. GROWTH OF ACQUISITION OF INDUSTRIAL AD HOC CLIENTS AND INCOME THEREFROM



APPENDIX B

REGIONAL DISSEMINATION CENTER IMPACT STUDIES

NERAC

Case No. 1

New England Research Application Center
School of Business Administration
University of Connecticut
Storrs, Connecticut 06268

October 29, 1968

General Considerations

The first contact between NERAC and the company was in October 1966 as a result of an article in a Massachusetts Chamber of Commerce newsletter. The company took the initiative in requesting a meeting to discuss NERAC's services. Since NERAC did not become effectively operational until July 1967, relations with the company languished until October 1967 at which time the company entered into an arrangement to be supplied with current awareness information in their primary field of activity -- glass-to-metal sealing, particularly for headers for transistors. The company did not, at that time, have a product as such and was more properly regarded as performing services for other companies in relation to these companies' own products. The client's manufacturing operation was essentially a low overhead one with a relatively unskilled labor force. The process itself was of medium technical sophistication but did not need technical sophistication to maintain it in operation. The number of employees at that time was in the 50-99 range but varied according to the work load. Most decision making devolved on the President of the company, and the retention of NERAC was no exception to this. It is also clear that the President was, and continues to be, the sole source within the company of information about externally generated technology which might have an impact on the company's future.

In addition to an interest in the primary field of the company's activity, some concern was also shown for the acquisition of a new product or of a new process leading to the performance of a new service. The specific fields mentioned were, for the product, reed switches or relays; and, for the process, the use of infra-red in the precise control and location of heating in a dissimilar metal bonding process and for routine testing of sealing heat cycles. However, no formal arrangements were made to perform searches in these two additional fields; and since it was obvious that searches for glass-to-metal sealing information could not easily be extended to cover these additional fields, nothing systematic was done about these subjects. However, as a gesture of goodwill, a retrospective search (both computer and manual) was performed for reed relay information and an intermittent monitoring of Tech Briefs was also performed.

Results

1. The retrospective and current awareness searches for information about glass-to-metal seals:

   These searches have been proceeding since November 1967 and, to date, the company has received the abstract results of a retrospective search of the tape file, abstract results from the monthly update of the tape file, and citation results from an intermittent monitoring of "Engineering Abstracts", "Applied Science and Technology Index," "Engineering Index," "Business Week," the U.S. Patent Office Gazette, and NASA Tech Briefs. In total, 8 installments of the current aware-

ness search have been completed to date. The results comprise 19 abstracts from the tape file (7 from the retrospective search and 12 from the current awareness search) together with 17 citations, etc. from manual searching (6 from the retrospective search and 11 from the current awareness search). In addition, the client was given one computer print-out in order to check whether his evaluation of the print-out differed materially from NERAC's own. No documents have been ordered by the client.

When questioned about the efficacy of the search, the President of the company considered that none of the references produced were "close enough." He further commented that the individual references were very much like those he himself discovered in monitoring successive issues of "U.S. Government Research and Development Reports." It is ironic that the client considered the search results as covering too broad a field to be relevantly responsive to his needs since it has been NERAC's experience that the field, as defined and monitored, was in fact too narrow and too specific, satisfactorily to be the subject of a tape based current awareness search. This is attested to by the paucity of "hits" even with a relatively broad search strategy in this narrow field and the need to institute manual searching in order to avoid the embarrassment of successive monthly nil returns.

In further discussion with the President, it became clear that the original definition of the search topic was

imprecise. In fact, what was wanted was not information on glass-to-metal seals and sealing techniques but rather for ".....information about dissimilar materials which can be processed in approximately the same way as used in conventional glass-to-metal sealing techniques, using preformed glass which is either matched or responsive to compression and having the following additional characteristics:

a) hermeticity in the bond down to 1×10^{-9} as measured by a helium leak detector,

b) bondable in temperature ranges up to $2050^{\circ}F$,

c) able to withstand, after bonding, heat cycles of $-65^{\circ}C$ to $600^{\circ}C$,

d) possessing electrical resistances of 10^{-10} ohms at 1000 volts at 80% humidity."

Essentially, this means that the company has no wish to affect the low overhead nature of its manufacturing operation either by adopting more esoteric techniques or by diversifying into different kinds of seals. What is wanted is new or modified materials that are similar in all respects to the present ones except in the one quality of heat resistance or high temperature performance.

The present status of this search, in the mind of the President of the company, is to treat the matter as an abandoned experiment. NERAC proposes to make a special effort in the remaining 3 months of this service to locate information more precisely in line with the need. The company is not inclined to renew its association at the expiration of the

current period of performance -- certainly not at the level of present annual membership fees. In concluding the discussions on this aspect of NERAC's work, the President remarked "Well, you don't get much for $300 these days and I didn't."

2. The retrospective search about reed switches and relays:

The search produced 15 abstracts from the tape file and 21 citations from manual searching. A limited manual monitoring was continued after completion of the retrospective search in anticipation of an order to search. However, after about 3 months the company's interest in the subject vanished and the order for the work never materialized. When asked about the reason for this loss of interest, the President said that although originally reed relays were regarded as a possible new product, market and marketing uncertainties together with the advent of an alternative diversification possibility, dictated an abandonment of interest in the subject.

3. Monitoring infra-red heating technology:

Although not a part of the paid-for service, intermittent monitoring of this field, particularly of Tech Briefs, brought to light Tech Brief No. B66-10268 (see page 9) -- a high-speed furnace using infra-red radiation for controlled brazing. This was brought to the attention of the client in December, 1967 and was found to be of immediate interest. An attempt was made to build a furnace but this was unsuccessful due to focusing problems. Response to letters to the AEC was apparently zero. By April, 1968 NERAC recommended an approach to the T.U. officer at the Space Nuclear Propulsion Office (SNPO), Germantown, Maryland, and was instrumental in arranging for telephone

conversations between the client and the T.U. officer. Two visits to Germantown were made by the President and a prototype furnace was made available to the company on indefinite loan for experimental and test purposes. During the experimentation, some modifications were made to the equipment but at no time could a temperature of 800°F be exceeded although the Tech Brief stated that the furnace ".....will be capable of producing controlled heat.....over a wide range of temperatures (from 100° to more than 2000°F)." Renewed contact with the SNPO T.U. officer provoked a visit by him to the company's premises and this was followed by a visit from the T.U. officer at the Electronics Research Center (ERC) who undertook to consult his technical colleagues about the possibility of modifying the furnace to give a better performance. The SNPO T.U. officer also caused contact to be made with the contractor who performed the original work for NASA, whose spokesman denied that the furnace had ever been designed to reach a temperature of 2000°F and commented that if NERAC's client wanted a furnace to reach 2000°F, his company could supply one.

There the matter rests for the moment. If ERC can advise NERAC's client about modifying the furnace successfully, then they propose:

(a) to use the furnace for routine testing of temperature cycles for the glass-to-metal sealing processes and an ancillary brazing process. (i.e. End point utilization of a device by in-house manufacture of it.)

(b) to investigate the feasibility of making molybdenum/copper bonds. (i.e. Development and utilization of a process by using it to manufacture a product for sale.)

(c) to manufacture a modification of the device for sale to specialized users not previously identified as a potential market. (i.e. Development and utilization by manufacture of a device for sale.)

Whether these hopes will be achieved remains to be seen.

Conclusions

This case teaches a number of lessons:

(a) Precise definition of the area of the client's interest in a functional as well as a subject sense is vital.

(b) Continuing dialogue is important to detect when a change in client's interest occurs.

(c) The nature of the company's operation and the decision-maker's attitude to it greatly affects the potential utilization of the information and, by extension, therefore, the client's view of its 'relevance'.

(d) In terms of existing product and process improvement, the likelihood of the utilization of information supplied is greater when the resulting change

to the stable characteristics of the existing product or process is at a minimum - not at a maximum as often assumed.

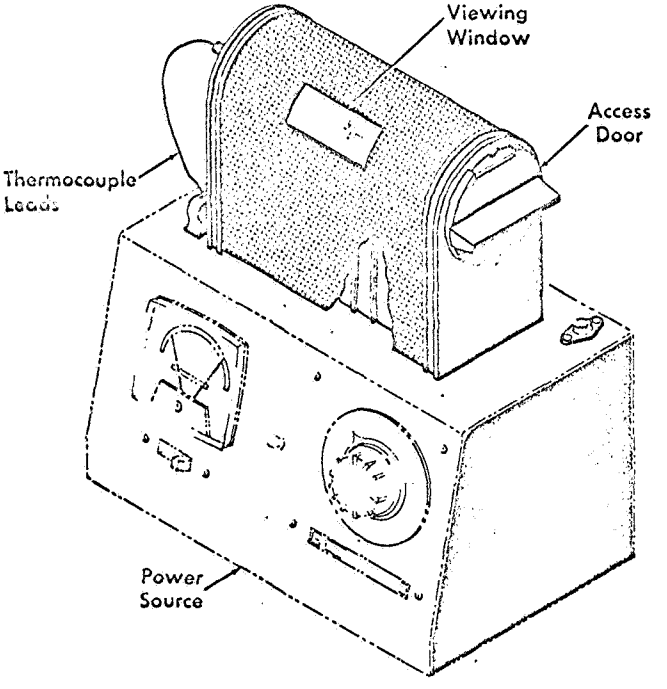
(e) In company situations where there is a single point for the reception, assimilation, and the initiation of utilization of the information disseminated, the limitations upon effective performance in this respect are quite stringent and raise the issue of client qualification for service.

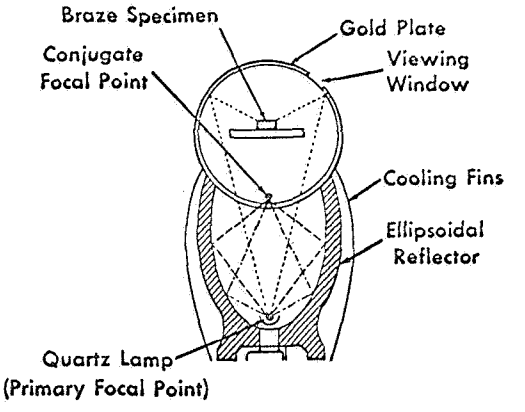
(f) The supply and assimilation of technical information is a small part of everything involved in the successful adoption of a new product or the adaptation of an existing process in response to the imperatives created by the awareness of a specific piece of new technology.

(g) The effect of an inaccuracy occurring in a Tech Brief is shown to be potentially very deleterious to the client's attitude.

NASA TECH BRIEF

High-Speed Furnace Uses Infrared Radiation for Controlled Brazing





END VIEW
(SCHEMATIC)

The problem:

To design a furnace that will be capable of producing controlled heat for brazing and heat treating metals over a wide range of temperatures (from 100° to more than 2000° F). The furnace must operate with a simple power supply, maintain a pure atmosphere required for brazing, be capable of rapid heatup and cooldown, and permit visual observation of the braze specimen. Conventional furnaces, including those employing gas or rf induction heating, are deficient in one or more of these attributes.

The solution:

A furnace employing a near-infrared heat source positioned at one focus of an ellipsoidal reflector mounted below a cylindrical quartz chamber in which the braze specimen is placed.

How it's done:

A quartz lamp is mounted at one focus of an ellipsoidal reflector made of highly polished aluminum. This assembly is mounted below a quartz cylinder, which serves as the furnace chamber. The conjugate focus of the reflector, where most of the radiant heat energy from the lamp is concentrated, is located immediately inside the quartz furnace chamber. This chamber is gold plated over most of its exterior surface to ensure that the radiant energy will be reflected toward the braze specimen placed within it. Two portions of the chamber are unplated, one portion to allow

(continued overleaf)

entry of the infrared radiation and the other to allow visual observation of the braze specimen.

One end of the furnace chamber has a sealable, hinged access door, and the other end is arranged to provide for the insertion of a monitoring thermocouple and circulation of a gaseous atmosphere. Single-phase, 60-cycle electrical power supplied to the lamp can be varied from 115 to 280 volts in order to control the temperature of the furnace, as sensed by the thermocouple.

Notes:

1. For a specimen of medium size in a furnace chamber 12 inches long and 6 inches in diameter, a complete brazing operation required only 30 seconds for heatup and 1 minute for cooldown. Heat concentration toward the braze specimen was so efficient during the brazing that the exterior of the furnace could be touched without discomfort.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   AEC-NASA Space Nuclear Propulsion Office
   U.S. Atomic Energy Commission
   Washington, D.C., 20545
   Reference: B66-10268

Patent status:

The heat source configuration, consisting of the lamp, ellipsoidal reflector, and cooling fins, is covered by U.S. Patent 3,242,314, issued to the Aerojet-General Corporation. NASA does not contemplate patent action for the overall furnace configuration.

Source: P. N. Eckles
of Aerojet-General Corp.
under contract to
Space Nuclear Propulsion Office
(NU-0047)

REGIONAL DISSEMINATION CENTER IMPACT STUDIES

NERAC

Case No. 2

New England Research Application Center
School of Business Administration
University of Connecticut
Storrs, Connecticut 06268

November 13, 1968

General Considerations

Contact with this client was first made in November, 1966, during studies of the feasibility of establishing NERAC. On the basis of the results of a questionnaire and personal interview with the President of the company at that time, the prognosis for inducing the company to become a client was not good. The company was satisfied with its current methods of acquiring information (company library and technical journals). The President commented, "I don't know what we can learn from NASA; we're teaching them things." His reaction to a question about his company's need for technology was,"We make technology." However, he was responsive to a generalized appeal for industrial patronage, without which NERAC could not become operational, and indicated his willingness to give support to the program by demonstrating an intent to use NERAC's services when these became available.

The company, at that time, had 150 employees with four technologists responsible for product improvement, development engineering, and research. Its manufacturing activities were almost wholly concerned with the production of small structural metal parts (gears and various special equipment components) using metal powders in accordance with manufacturing techniques generally known as powder metallurgy.

After NERAC became operational in July, 1967, contact with the company was re-established through their Chief Metallurgist. In September, 1967, the company bought a retrospective search with a continuing current awareness service for the ensuing 12 months. The search title was "Fabrication of Small Structural Parts from Powdered Metal." The subject terms used for the computer searches were "Powder Metallurgy" and "Metal Powder." At the time the company became a client, a NERAC applications specialist defined the specific interest of the company as: "Powder metallurgy as applied to small structural parts (gears, etc.); use of cold pressing methods, ferrous materials -- some stainless steel, also brass, bronze; advanced pressing techniques using conventional apparatus; powder metallurgy filters; helical gears; electrical properties of titanium and aluminum; press design; hydraulic presses; frangible bullets via powder metallurgy -- tools and techniques; low temperature pressing using steel dies; interested only in material that can be of specific help to the company now, not far-out stuff; not interested in hot pressing (except academically) large parts, friction materials, abrasive materials, composites, graphite molds, exotic materials or superbased alloys."

The search strategy used in approaching the computer did not reflect these exceptions and qualifications. It was decided that post-search evaluation could more effectively do this.

It is perhaps timely to note at this point that the Chief Metallurgist has subsequently said that at the time the search was commissioned, he himself had no doubt that the results would

have little significance in terms of immediate utility for the company. He concurred in the decision to go ahead as a matter of general interest and to ".....get a feel for what NERAC could and would do." His doubts were based on his experiences of 'Government literature' when employed at Frankford Arsenal, the evidently satisfactory nature of the company's existing methods of acquiring information, and the inherent difficulty of obtaining the kind of information wanted -- namely, information proprietary to industrial competitors.

Results

The retrospective search of the tape file (number of hits no longer available) led to the selection and dispatch of an initial batch of evaluated abstracts (number also not now available). An additional 54 were sent at the request of the Chief Metallurgist after his review of the computer printout, and a further 19 were subsequently provided since they were referred to in the earlier batches. No documents were ordered. The recipient of this material, the Chief Metallurgist, was reported by NERAC's application specialist to be "pleased with the titles of the search abstracts but, as he had expected, the material in the documents would not be much use to his company." He was also reported as suggesting that NERAC should not "spend time on manual searches since he reads these journals himself." These comments were made after the receipt of the first installment of the current awareness search which included one citation from a technical journal -- not retrieved from the tape file.

The current awareness search, starting in November, 1967, continued through the twelfth installment and produced 132+ hits from the tape file (figures for the first and fourth installments are no longer available). Evaluation identified 32 abstracts of some relevance to the search topic and these were forwarded for the client's review. Since six of these monthly installments produced no more than one abstract worthy of the client's consideration and three others, no more than two, efforts were made to supplement these results by intermittent manual searching, despite the client's earlier strictures about not so doing. As a result, 52 citations in all were also sent for review, in addition to one NASA special publication, SP-5086 (The Shaping of Precipitation-Hardening Stainless Steels by Casting and Powder Metallurgy). At no time during the continuance of the current awareness service were any documents ordered which was testimony to the lack of imperative in the content of the abstracts and citations in terms of their short-term utility for the client. In fact, no documents were ordered until a week before the twelfth and final installment of the current awareness service. At this time NERAC received requests for 23 documents chosen from 105+ abstracts from the tape searches (both retrospective and current awareness) and 53 citations, etc. Eighteen of these were documents identified by tape searches; five came from manual searches of "Applied Science and Technology Index," "British Technology Index" and "Engineering Index."

An interview with the Chief Metallurgist for the company in the terminal days of the project confirmed his earlier-expressed views that nothing of interest had been uncovered of direct and immediate relevance to the manufacturing processes. When asked to rank the documents ordered in descending order of their significance to the company, only one document was considered to have more than general interest. This is N64-10767, "Certain Problems on the Welding of Metal Powders" -- work done in the U.S.S.R. Since this document had not been received at the time of the interview, this opinion was based on the content of the abstract. Since the reference was retrieved during the retrospective search performed more than 12 months earlier, it is clear that the company does not anticipate its contents to have any compelling imperatives to action.

Other points arising from the interview are:

1. The searches performed were acknowledged to be relevant in terms of the general area of subject interest but not of utility in the context of the motivation behind the need for information; i.e., existing process improvement and anticipation of competitors' projected process innovation.
2. Much of the retrieval related to work overseas, particularly from the U.S.S.R. The client's view of U.S.S.R. material, stemming also from his experience at Frankford Arsenal, was that nothing new was ever published there. Since the monitoring of foreign sources was initially represented to have potential benefit for the client, this created an element of disillusionment.

3. Interest was expressed in the results of the manual searches but only insofar as they confirmed the client's view of the scarcity of pertinent information outside the Government literature. The client considered that his own manual searching and monitoring was superior to NERAC's. This searching was aided by bibliographic services from materials suppliers, particularly the Hoeganes Corporation, Riverton, New Jersey. A Mr. Henry Hausner is an information consultant to this company for this purpose, and produces (amongst other things) a P.M. Newsletter. The client conceded that there were some sources which escaped his attention (e.g. the A.I.M.E.) and showed interest in an I.S.I.-like monitoring of journals not currently coming within his own review.
4. The client considered that the Government was, in general, behind the times in the conventional processing of materials in this field. He conceded merit in the fringe of the state-of-the-art but felt the esoteric nature of such work generally disbarred it from finding conventional utility.

An effort was made, during interview, to define the company context in its relationship to new technology and changes in process and product induced thereby. The Chief Metallurgist acquiesced in this with the following results:

There is no formalized group or managerial unit having responsibility for deciding about the adoption of new technology, but an informal group of management does spontaneously meet intermittently as the occasion arises (about 2-3 times a year). This results in some product and process changes -- for example, 4-5 changes in materials were made in the last twelve months. The Marketing group is an integral part of such discussions and decisions. The initiative for proposing discussion of changes comes generally from either the Chief Metallurgist himself or the Sales people. Sales poses the question, "Can we do so-and-so.....since we could sell it....." The thrust of the Chief Metallurgist's proposals are, "We could do so-and-so.....can it be sold.....?" The Chief Metallurgist said that so far as he was concerned, if he came across technology which he thought could be incorporated in an existing product or process, he would make a point of informally proselytizing some of his colleagues before the meeting. If the consensus of the meeting was in favor of going ahead, this would be done despite the fact that no literature search was ever called for to check whether what was proposed had, in fact, been done before or was in the process of being done. It was generally felt that this kind of information was not available anyway since it mostly related to the activities of industrial competitors and was naturally not published. This was not to say that the company was not aware of some new developments in the field, occurring elsewhere. For example, Battelle developed an autoclave gas pressure bonding technique which represented a radically new departure in the art. For the company, however, it remained of academic interest only since, amongst other

things, the process required an investment of $200,000 in equipment. It did not, therefore, fit in with the company's criteria for new technology utilization; namely, a reasonably balanced equilibrium of costs and quality as compared with current practices, ability to use, and capital expenditure.

Other points emerging from this dialogue were:

1. The company's information needs are essentially production oriented.
2. No consultant or outside help has ever been used to aid in the search for information. Graduate students from the local Polytechnic Institute have been used in the development and refinement of a powder metal welding process.
3. In acquiring information, applicability rather than speed is the predominating requirement.

An additional effort was made to define some company/interviewee characteristics. The Chief Metallurgist considered that:

(a) His company was progressive -- "more or less"; a leader in the industry; modern -- "we have recently bought new presses"; production oriented.

(b) His own suggestions about company development and diversification were, in general, "too radical, whilst being perceptive, and often considered impractical from a production standpoint." Nevertheless, top management sought his advice "frequently," which was always "listened to and considered and thus formed part of the picture."

(c) The atmosphere surrounding his work was autonomous but not conducive to creativity and, therefore, somewhat stereotyped. "My work is essentially a service to production, sales, and engineering; and although I am supposed to turn out new, original work, the need for 'cook-bookery', in the day-to-day operations, interferes." He said he regarded his job as "management and technical advice and guidance" and that his personal goals with respect to his job were, "an identification with the advancement of the company."

In response to a question about the company's objectives, he considered that, making money apart, they were "guaranteeing continued employment in the local community and maintaining a sense of respect for the company there."

In conclusion, the Chief Metallurgist expressed the view that there seemed little point in continuing the service even at the present level. He further considered that he could certainly not justify annual membership of NERAC at a level of $1,000 per annum. He remained relatively cool to suggestions that the literature searching should monitor other subjects contiguous with that currently being monitored; e.g., substitute materials, substitute processes such as diffusion bonding, alternative mold materials, and furnace techniques. He was also quite unmoved at the prospect of NERAC servicing his company's competitors.

Conclusions

This case teaches:

(a) Information needs oriented towards production improvement are unlikely to be met without a pre-recognition by the client that effective utilization of information will necessarily oblige him to make a positive input himself in terms of synthesizing and transferring it into the new context. It is unlikely that such information will be directly transferable in an unchanged condition.

(b) When the search topic is identical in all respects with the company's raison d'être, the chance of searches turning up something unknown to the company, of more than general interest, is more remote than in the situation when the topic is concerned with alternatives in one or more senses.

(c) I.S.I.-like monitoring of journals is found to be an attractive alternative to the individual monitoring conventionally carried out in industry, but old habits die hard. It is thought that a complete switch would remove an element of serendipity and synergism present in current practice. In any event, any client prepared to make this change would have to be completely convinced on the breadth of coverage.

(d) 'Bite-size' process improvements are regarded more favorably than radical substitutions -- particularly at the technical management level. This is not unreasonable since it is not generally the function of technical management to initiate and carry through technological revolutions. Technical management's job is more the incremental improvement of the existing process and product status quo.

(e) Applicability of information rather than speed of service is the predominating need of small process oriented companies.

(f) Care should be exercised in extolling the virtues of 'foreign' literature. Due regard must be paid to the context of both the company and the topic.

(g) Thought should be given to soliciting materials suppliers as NERAC clients since such companies often offer their customers a free information service as part of their overall service.

(h) Some effort should be made to compile cases showing that the esoteric behavior of today can become an industrial commonplace tomorrow.

REGIONAL DISSEMINATION CENTER IMPACT STUDIES

NERAC

Case No. 3

New England Research Application Center
School of Business Administration
University of Connecticut
Storrs, Connecticut 06268

December 17, 1968

General Considerations

Contact with this company was first made during the course of studies to determine the feasibility of providing a technical information service for industry in the New England region. This occurred in November 1966, when the President and Plant Manager of the company responded very positively to an exposition of NERAC's services and skills. Not only did the President execute a letter of intent to become a member of NERAC but went to considerable trouble to list other companies in the general area which might have an interest in NERAC. He also offered to help to initiate contact with these companies -- several of which subsequently became members of NERAC.

A visit report made at the time of this first contact reflected the euphoria. The company representatives were considered to be ".....the nicest, easiest people I have had to deal with..... extremely forward looking, very progressive....." The area of interest of the company was defined as ".....all aspects of ratchet technology....."

At this time the company employed 25 people, three of whom had technological responsibilities for product improvement and production engineering. Only informal intermittent methods were used for acquiring technical information which were characterized as partially effective but nonetheless inadequate. The field of interest was quite specifically ratchets and needs for technology related just as specifically to existing product and process improvement. An ancillary desire was to improve management techniques, particularly in the area of customer feed-back. The company President

considered that an RDC might help in the identification and diversification of applications for the company's product line and showed an open mind about the usefulness of other RDC services such as seminars, workshops, marketing surveys, licensing assistance, and the supply of management science information.

NERAC did not become operational until July 1967, and it was not until September 1967, that contact with the company was renewed. At this time the company entered into an agreement with NERAC for the provision of a retrospective search and subsequent current awareness searches over a period of 12 months on the subject of 'Ratchet Technology.' The NERAC Applications Specialist reported the precise area of technological interest in somewhat terse terms: ".....last company in the United States that makes ratchets. Used in positioning devices, overrunning clutches, seat back positioners. Cheap and useful for some applications. Interested in new, possibly more sophisticated and exacting uses....." 'Index', 'positioning' and 'unidirectional' were suggested as search terms for the tape file.

Results

The performance of the initial retrospective search immediately underlined a dilemma, continually occurring where the specificity of the search topic is not equalled by the specificity or immediate relevance of computer search terms. It is, of course, possible to negate the results of this absence of direct fit -- at least conceptually -- by conventional 'technology transfer' arguments.

Since a 'ratchet' can be described at a higher level of generality as a 'mechanical motion control device' and since, in terms of function, a 'ratchet' can perform a number of functions; for example, 'over-running', 'back-stopping', 'indexing', 'locking and unlocking', 'free wheeling', 'free running', 'braking', 'adjusting', 'positioning', 'reversing', 'clutching', 'sequencing', and 'unidirectional movement', it is possible to conceptualize second generation search terms thus increasing the possibility of fit with computer search terms. The value of doing this, of course, does depend on the existence of a potentiality for the 'horizontal' transfer of technology from one discrete area of application to another, related to the first but not, on the face of it, obviously so. For example, the refinement of the accuracy of the performance of gyroscopes can lead to an order of magnitude improvement in automobile bearings but, in general, very sophisticated indexing and understanding would be necessary to allow the machine retrieval of a document devoted to gyroscope design for an automobile manufacturing client. It would probably also be difficult to persuade him (on the basis of an abstract) of its relevance and importance to car bearing performance; and if this is the case, it is unlikely that the document would ever be ordered.

In the present case of ratchets, the indexing authority for NASA documentation -- the NASA Thesaurus -- does not contain the term. Neither does the Thesaurus of Engineering Terms of the Engineers Joint Council, nor does that of the Defense Documentation Center. The seemingly elusive nature of the subject is, however, refuted by an entry in the index to Thomas' Register of North

American Manufacturers, which lists no less than 23 categories of ratchet. For the retrospective search of the tape file, therefore, recourse was made to second generation terms. The search strategy intersected 'Mechanism' with 'Index' and 'Positioning' and 'Positioning Equipment' and 'Uni-directional'. The number of hits obtained from this search is no longer available, but Information Services reported to the Applications Specialist, "We have found nothing in the tape file to date (only trash), but .....(there is).....a wealth of material in the published literature." A further machine search was conducted using the single search term 'Positioning'. Again the number of hits from this search is not available but, once again, Information Services commented to the Applications Specialist, ".....I am sending attached the print-out for the term 'positioning'. I have looked through it and see no promising material. Let me know if you would like any of the abstracts." Additional memoranda from Information Services conveyed the need to ".....do some manual searching and try to get some information from knowledgeable individuals....." In the end the results of the retrospective search transmitted to the client comprised 20 manually retrieved citations together with the articles themselves (all of which did refer to 'ratchets') and 8 abstracts selected from the 'Positioning' search print-out -- which related very loosely to position control devices none of which, however, were specifically ratchets.

A review meeting with the President of the client company about these results revealed that he was "extremely pleased" with the manually retrieved references and that he proposed to "..... build up a library of ratchet articles." In view of this, he

requested that the manual search might continue and be extended. The computer-retrieved abstracts were judged to be "less useful." However, the NERAC Applications Specialist, referring to the President of the company, noted that ".....he indicated that a search in very broad areas might produce extremely valuable results. He is approaching this part of the search with an extremely open mind and is willing to put much time into analyzing the material that we send him." Further suggestions were made for second generation search words including 'mechanical', 'motion', 'control', 'coupling', 'index', 'braking', 'locking', 'clutch', and 'idler'. Two additional search strategies were constructed using various combinations of some or all of these terms and were used in the search for the first installment of the current awareness service. Several such searches were performed during the next two months. Supplementary manual searching was also done -- this manual searching extending on one occasion to a review of U.S. Government procurement invitations for ratchets. The sum total of this activity was arbitrarily judged to respond to NERAC's obligation to perform the first of twelve monthly current awareness searches. Although the number of hits obtained in the computer searches for this first installment is no longer available, only one abstract was forwarded to the client. The manual searching produced 13 articles and citations (including 1 U.S. Navy requirement for ratchet lever type hoists) and 3 NASA Tech Briefs. Ten documents and 3 Tech Briefs were dispatched to the client, including the lone retrieval from the tape file.

An appraisal of all activity to date in February 1968, led to the melancholy conclusion that an annual fee of $300 could not support the continuance of such a diversity of effort on behalf of the client. In view of this, the computer search strategy was stabilized and recourse was made to searching on behalf of the client, more in line with that performed for others for the same fee. The result of machine searches for installments 2 through 6 produced only 9 hits relating to documents, too remote from the target subject to be of value. No abstracts were sent to the client. Reports of nil returns were made. This inability to produce any results from the tape file forced a return, once again, to manual searching in the U.S. Patent Office Gazette, Applied Science & Technology Index, and British Technology Index. This produced, for installments 6 through 9, a total of 13 citations, relating to which 3 documents were ordered. Two of these citations were concerned, once again, with U.S. Government procurement invitations for ratchets. A monitoring of recently issued Tech Briefs produced one of some relevance but of no evident importance during the same period.

Summarizing results from the retrospective search through the 9th current awareness installment, the tape search produced 13+ hits, 1 abstract, and 1 document ordered. Forty-six citations from manual searching produced orders for 33 documents and articles. Four Tech Briefs were also sent.

Intermittent contact by telephone and letter was maintained by Applications and Information Services. After the 4th current awareness installment, a visit to the President of the company was

made. The Applications Specialist reported that his reception was "most cordial" but that the client felt that ".....he has not been getting too much out of his CA on ratchet technology. In terms of servicing this client, we have been less than successful. Areas of improvement required and comments follow.

> Applications service as part of CA - Mainly consisted of document procurement with one good plus -- the Navy IFB which the client appreciated. Last visit recorded is the one before the RS/CA ordered. Rest of contact was by phone and letter.
>
> Manual searching of CA question - In the RS and earlier CA's manual searching was done. Cambridge office letter indicated this would continue.
>
> The last two installments were clearly NASA/AIAA tape searches only. This is a major change in service the client has been led to expect by previous performance. He indicated the manual search results were useful.
>
> Client use of documentation provided - He is still in the 'collecting' stage. He is supplementing our service by infrequent manual searching of his own. He feels they are leaders in their field; and when he has collected a 'suitable' amount of information, he plans to publish 'something' for use by his customers and his own staff, plus promotional material.
>
> It is my opinion that he has lost some of his confidence in NERAC, but he still feels NERAC could do a better job on this than he could. He will not consider even a 6 month membership at this time."

An interview with the President to determine the impact of NERAC's services was sought and obtained after receipt of the 9th current awareness installment in November 1968.

The thrust of the President's comments indicated that the nature of his motivation in making use of the service had changed since its inception and was more to use the information as information with no particular intention than to reduce it to practice in terms of new products and processes. In effect, the relevant

information (exclusively retrieved by manual searching) was being allowed to accumulate to a point when it would be possible to write a definite history of the development and application of the ratchet. In addition, applications and variants would be catalogued to provide ideas both for the sales and engineering departments.

It was confirmed that the results of the machine searching had been, at best, 'peripheral' in usefulness. It was denied that other aspects of the search subject were of interest -- for example, alternative materials. If plastics were a contending substitute material, recourse to supply houses would be made rather than to the literature of plastic materials characteristics. It was conceded that methods of actuating ratchets might have some merit as an alternative search subject and that a monitoring of technical journals for mechanical, uni-directional motion control devices might be useful. All these alternatives were basically of marginal concern as compared with the main subject. It became clear that the President's interest in the historical aspects of ratchet development did open the door to intensive retrospective manual searching in addition to a current awareness service.

In concerning himself with his company's behavior with respect to the commercialization of new technology and its information gathering characteristics, the President made the following points:

1. An Advisory Committee comprised of departmental managers and chaired by himself, meet regularly to consider new projects and projects in progress.

PERT techniques are used for on-going projects. A formal and exhaustive new product evaluation technique is used for proposed new products which ranks 24 qualities on a scale 1-5 in ascending order of desirability. These qualities are:

a) Functional need
b) Potential size of market
c) Potential share of market
d) Potential market growth
e) Durability
f) Stability
g) Exclusiveness
h) Availability of engineering personnel and knowledge
i) Time for development
j) Utilization of engineering strengths
k) Production equipment
l) Production knowledge and personnel
m) Raw materials
n) Manufacturing load
o) Utilization of production strengths
p) Distribution channels
q) Relation to present products
r) Effect on present sales volume
s) Customer's products and distribution
t) Promoteability of product
u) Relationship to present environments
v) Funding available
w) Management support
x) Compatibility with management capability

2. Marketing personnel are involved in the evaluation procedures from the beginning since most new product needs are initiated by them.

3. Design improvement and diversity of application of the company's product are the main motives for new product development.

4. Information needs reflect the needs of any leading company to stay abreast of the state of the art and to know its field thoroughly in a retrospective sense as well.

5. Consultants have occasionally been used in finding information, but most needs are supplied from within the company.

6. Completeness rather than speed is the predominating factor in acquiring information.

7. The company does not have its own library but, even so, the President said he spent an average of 2 hours per day in searching for some kind of information.

8. The following is a ranking order of sources of information used most frequently by the company:

a) Texts
b) Meetings
c) Personal contacts
d) Libraries/consultants
e) Journals
f) Acquisitions from information centers and abstract services
g) Suppliers' personnel
h) Catalogs of suppliers
i) Government publications

In conclusion, the President reiterated that his company's objective was to be and remain the leader in the field and, in the longer term, to become a significant supplier of mechanical motion control devices.

Doubt about the merit of continuing the NERAC service into the second year on the basis of an annual membership was resolved by offering to continue on a monthly basis at time and materials plus 20%, with an option to cancel at any time.

Conclusions

This case teaches:

(a) Care should be exercised in assuming and contending, for purposes of client recruitment, that the use of second generation index terms will necessarily achieve a satisfactory specificity of retrieval which at the same time exhibit the necessary degree of relevance. The willingness and ability of the client to make the necessary translational inputs should be assured to begin with.

(b) The value of information retrieved is more readily appreciated by companies such as this in the context of its use as information alone and not as a trigger for activities leading to its reduction to practice. It would seem important to identify the real motivation behind the client's retention of a RDC services at the beginning. In this case, it would have been explicit from the beginning that what was really needed was a retrospective search primarily from non-machine sources. If the relationship with this client continues, it will certainly be along these lines.

(c) Notwithstanding the lesson taught in (b) above, this client and, presumably by extension, other clients of a similar nature find useful a service which provides a continuing monitoring of business opportunities afforded by U.S. Government procurement needs.

(d) Any experimentation in the use of the tape file which has the goal of defining potential examples of 'horizontal' transfer using second generation search terms, should be clarified with the client in advance and should be based on a understanding that this additional effort needs to be funded beyond the cost of more conventional search activities.

(e) With companies of this kind, the imperatives surrounding their commercial stability tend to outweigh the implementation of any desire to become involved in the frenetic world of new processes and product diversification. There may be an understanding of the potential merit of projecting upon and diversifying the original subjects but an inability to properly assimilate and act upon the results usually inhibits this.

(f) Since marketing personnel are frequently, as in this case, involved from the beginning in considerations of product development and diversification, perhaps some educational effort about the merit of a RDC services could be profitably directed to such people.